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ABSTRACT

An educator who teaches physics to grade 12 students and a physics curriculum and methods course to preservice teachers analyzes the impact of context on teaching practice. A paper by A. Richert titled "Voice and Power in Teaching and Learning To Teach" is used as the foundation for interpreting the author's experience of teaching physics in grade 12 at the same time he was teaching others to teach physics. The paper outlines some personal values, contrasts the contexts of school and university, compares the second year of experience to the first, bridges the worlds of theory and practice, notes the importance of teacher research, and examines differences between transmission teachers and interpretation teachers. The paper concludes that learning how to connect the two parallel tracks of experiences and thinking about "teaching and learning" is central to personal development as a teacher but is ignored by both schools and universities. The paper also concludes that, as university-based researchers in education have worked to study teaching from the "outside-in" perspective, they seem to have overlooked the golden opportunity to do research on their own teaching within teacher education programs. (Contains 14 references.) (JDD)

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ED 361 293

A TEACHER EDUCATOR REFLECTS ON THE IMPACT OF CONTEXT ON TEACHING PRACTICE: SEEKING VOICE IN TEACHER AND TEACHER EDUCATOR RESEARCH ON PRACTICE[1]

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INTRODUCTION

This is the second academic year in which my teaching has included two closely related courses: teaching a physics curriculum and methods course to 20 pre-service teachers, and teaching a class of 25 Grade 12 physics students. The first course runs from September through April, including 20 weeks of on-campus courses and 9 weeks of practice teaching (four placements, the first for three weeks and the remaining three for two weeks each). The second course runs from September through January, in 76-minute classes each day at a school 10 minutes' drive from the university.

There were many purposes to this arrangement, in which I was joined by the teacher who would otherwise have taught the Grade 12 class. In return for my daily teaching, he came to the Queen's campus once a week for a two-hour class with the pre- service physics teachers. The arrangement seemed to work quite well for both of us, as he gained a professional opportunity to influence those just beginning their careers as science teachers and I gained a professional opportunity to remind myself of the "very fine details" of the work for which I was preparing the new science teachers.

PURPOSE

The purpose of this paper is to consider the significance of *context* from the perspective of teaching and teacher education. Moving daily between university and school was a powerful reminder not only of the different routines but also of the different perspectives. As a teacher educator, I was "beginning again" as a physics teacher, and I was teaching not just for myself but for those whom I was helping to learn to teach. Also, I was extending my understanding of what "learning to teach" means by direct participation. As a teacher, I was putting my sense of confidence as a teacher educator on the line. "Could I do myself what I ask of those starting their careers as teachers?" Thus context was everything at times. It was a rich, powerful, exciting, and demanding experience. The extra time and

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effort were amply rewarded by the many "new beginnings" that emerged in thinking about the enterprises of teaching and teacher education.

As I approached the task of exploring the issue of context in teaching and teacher education, Richert's (1992) paper on "Voice and power in teaching and learning to teach" prompted a great deal of critical thinking about the experiences and became an initial focus for interpreting my experiences. I realized the importance of applying her perspectives to myself and to the preservice physics teachers.

> Two central assumptions form the basis for my consideration of learning to teach . . . . The first is that teachers are learners. . . . we often lose sight of the critical importance of learning as an ongoing part of professional practice. . . . In the process of reflective practice teachers become "students of education" who can act with intent as they responsibly examine the many complex aspects of their classroom practice . . . [and] construct knowledge about teaching and their work as teachers.
> A second assumption . . . is that teacher-learners, by definition, are, and ought to be, constructors and definers of knowledge as well as dispensers of it. (p. 188)

> The idea of teacher conversation has embedded within it the concept of "voice"--the use of language to explain, describe, question, explore, or challenge. As this mechanism of conversation and explanation, voice is critical to teacher education. Considering and cultivating it are especially important in this arena given the vital connection between voice and learning, and given the prohibitive and isolating structure of school and schooling that limits its expression. (p. 189)

Other quotations illustrate and extend this perspective on the relationship between voice and professional learning:

> Teachers who talk about what they do and why, are able to know what they do and why, and to question themselves as well. (p. 190)

> For student teachers, the opportunity to talk about their actions, their thinking, their beliefs, and their feelings, is part of the process of learning to be a reflective teacher. (p. 191)

> Voice is a vehicle for reflective practice which results in ongoing learning in teaching. Knowing how to speak, including how to frame questions, how to grapple with answers, how to identify problems and focus on solutions, how to use theory to inform practice, and so on, is as important as knowing what to speak about. Programs of teacher education must have a structured expectation of voice; they must provide ample opportunity and a safe and supportive environment for the voiced conversations to be exercised. (p. 192)

> Listening to yourself as an authority on your own experience . . . is an important part of learning. In fact listening to your own words and attempted explanations is fundamental to reflective practice that results in learning to teach. While the power of speaking lies in part in the fact of being heard, being heard is not something that can be taken for granted in teaching. For one thing, being heard implies that someone is listening and there is no norm for

> listening to teachers within the professional community of schools. Beyond the norms of the profession, the demands on teachers' time preclude much reciprocal conversation among colleagues; teachers are too busy to listen to themselves let alone listen to one another. (p. 193)

These comments by Richert inspired new interpretations of what I accomplished in the second year of my "one foot in each context" experience, teaching physics as I was teaching others to teach physics. The analysis that follows has also been encouraged by electronic-mail discussions with Jack Whitehead (University of Bath), Stefinee Pinnegar (Brigham Young University) and Anita Roychoudhury (Miami University of Ohio). Doug Roberts (on leave from the University of Calgary) visited Queen's for two one-week periods during the fall term, observed both courses several times, and provided many useful insights during our discussions.

PERSONAL VALUES

To begin, I need to state what I take to be major values I hope to express in my teaching, values rooted in my own experiences as a physics teacher and as a teacher educator.

1) It matters a great deal to me that my students *think* about the topics I am developing with them. I do not believe that knowledge transfers directly or simply from words (spoken by me, written on and copied from the blackboard, or written in the text) to concepts that replace existing understandings--either of topics in physics or of topics relevant to teaching. I have developed a variety of strategies to signal this goal. I always find that students have a strong preference for "being told," and this is a familiar pattern of all who attend secondary school or university.

2) It matters a great deal to me that students be able to relate ideas to practical situations. It frustrates me when physics students seem forced to ignore everyday applications in favor of more abstract concepts. It frustrates me when pre-service teachers are driven (by their lack of experience) to focus on topics that are available in professional books, when the larger issues of taking charge of one's own professional development as a teacher seem to me so very important.

3) It matters a great deal to me that students feel able to "talk back" to me. At times I am unable to plan further lessons without some signals back from students about their reactions to what I have just done with them. What students tell me about their own sense of their learning always inspires me to the best teaching that I do.

4) It matters a great deal to me that we who teach students and who teach others to teach work constantly and creatively to reduce the gap between what we think we are doing and what our student-clients perceive us to be doing. Every teacher has very good intentions. It is remarkably easy to assume that those intentions are apparent to others, yet the many criticisms directed to schools and to teacher education suggest that our good intentions are not realized as much as we would wish. It is in part because Schon (1983) takes as a starting point the gap between "theory" and "practice" that I have found his analysis of dilemmas of professional practice so useful in teaching and research.

These values were major factors in my teaching behaviors in both contexts. In different ways, I made moves to get students thinking and sharing their thinking with me.

Each setting provided ample opportunity to consider how theory and practice relate to each other. And at different times and in different ways, I tried to elicit "back talk" from students, their reactions to what I seemed to be doing in the role of teacher. I tried to model the behaviors I recommended to the beginning teachers, and I freely shared with them the backtalk from the physics students. I also recommended to them my personal practice of almost-daily notes to myself about my physics teaching, and shared with them the first 16 days' notes as an illustration just as they left for their first practice teaching assignment.

DATA

With these as an initial indication of the values that I hoped would guide my actions in the two very different contexts-- university teaching of those learning to teach physics, and school teaching of those learning physics--I turn now to the data that shed light on the experience. One major source of data is my personal "dear computer screen" notes to myself on more than 80% of the school physics classes. Unfortunately, I do not have similar notes from the university classes. Another source of data is "backtalk" from the Grade 12 physics students on several occasions during the semester.

There is an overall theme that I wish to identify at the outset. Richert's comments about voice are all the more significant because neither the Grade 12 physics students nor the pre-service physics teachers seem to have any sense of the meaning of Richert's comments, yet her comments seem just as relevant to the learning done by students as they do to learning by teachers. Students have so very little experience of their own voices being meaningful in their schooling that many of my attempts to encourage them to speak were met with disbelief and denial. Perhaps because I saw them five days a week, the Grade 12 students seemed to catch on more quickly to my requests for backtalk. Speaking generally, the beginning teachers seemed so focussed on acquiring "the tricks of the trade" that they could not believe that their own thoughts and reactions could or should play a significant role in their own learning. Of course, there were exceptions to this generalization. One student teacher has been inspired to write more than any student I have worked with in 17 years. Several others have kept their own journal entries and are now beginning to share those with me as they draft the "story of their year learning to teach" that I require of them as a final course assignment.

The data are organized under five headings. The sheer volume of data dictates that the material be provided at the end of this account. The reader may prefer to peruse the data before proceeding further, to have an idea of the nature of available material. The headings are not identical to the topics in the discussion that follows; rather, the questions serve as headings for the material that speaks to the topic of this paper.

* What was different in my second year of teaching in two contexts?

* Why is the pace of the physics teaching so frantic in the Grade 12 course?

* What did the Grade 12 students think of my teaching?

* What kinds of questions did the Grade 12 students really want answers to?

* How did the visits of the B.Ed. students to the school and my visits to observe them as student teachers during practice teaching affect my work with the two groups of students?

INTERPRETING THE SIGNIFICANCE OF CONTEXT IN TEACHING, TEACHER EDUCATION, AND LEARNING TO TEACH

The confidence to open my teaching to others

The knowledge that I had succeeded as a physics teacher many years ago, with a very different curriculum and textbook, gave me the minimum of confidence to return to the physics classroom. The experience of 15 years as a teacher educator gave me the minimum of confidence to invite my teacher education students to share in my day-to-day experiences. Successful experiences with "backtalk" at the university level (confirmed by what I read as the Grade 12 students wrote) enabled me to share that data as a way of encouraging new teachers to seek student opinions.

Why should a teacher educator hesitate to return to an earlier craft? We set ourselves up as experts, and in the university setting we are rarely challenged directly by those entering the profession, even though they may infer that we are distant from recent and relevant experience in the classroom. If I failed in the school context, even to the extent of having modest but readily apparent difficulties, my "reputation" among local teachers and in the eyes of my own B.Ed. students would be placed in jeopardy. Teaching is such a personal and tentative endeavor, different and unique with each class, yet it is also so very public. Little wonder that teacher educators and researchers are easy targets for teachers' criticisms when our confident pronouncements of solutions and alternatives do not match the realities of teaching in schools.

Changing contexts calls attention to the landscape

Moving back and forth between the contexts of school and university every day for more than four months raised many issues and valuable points of comparison:

* By taking students from my university course as student teacher in the high school class, I came to better understand elements of the student teaching experience and of the process of daily discussion between experienced and new teacher.

* By taking the idea of backtalk from the university to the high school, I made small beginnings at what Baird and Mitchell (1986) have called "metacognition"--helping students to think about their own learning. (I was encouraged by their efforts, but fell far short of the achievements of the teachers in the PEEL project, who worked as a team within a school.) I was pleased that the Grade 12 students took me seriously in these exercises, that one commented on this feature at the end of the course, and that I was able to share the data with the new teachers to show that what was possible in terms of dialogue between teacher and students about the learning process.

* In university-based teacher education courses, it is easy to say that a teacher is not required to "cover" the entire curriculum specified as "core" by the Ontario Ministry of Education. In such a statement, one is referring to the possibility of choosing some level of depth over breadth. By teaching to another teacher's pace, one based on covering the core physics curriculum for Grade 12, I was able to live the tensions as well as the advantages and disadvantages of the choice between coverage and depth. I would still prefer to reduce coverage in favor of more time to work for understanding of basic concepts, but I now understand and fully respect the decision of a teacher to opt for coverage. It is a very personal decision, never taken lightly, and the tensions remain regardless of the final choice.

I have no way of knowing whether my own comments "induced" the students' backtalk about wishing they did not have to rush through the course at the pace specified on the first day of school. As I re-visit their comments, I am not even sure that I paid much attention to their very clear comments about pace. The timing of topics was the one element of my teaching that was in the hands of my teacher-partner whose schedule I agreed to follow.

The significance of the second year of teaching

I was taken completely by surprise when I realized, in the opening weeks of the second time teaching the Grade 12 course, how many options became available to me because I could clearly remember the choices I faced in the first year as I looked at each day's topics, homework problems, and demonstrations. Where my first year involved learning how to put textbook, problems, and demonstration equipment into a workable sequence, the second year involved realizing just where and when to stress particular points and make specific connections between ideas, observations, problems, and common "misunderstandings."

I am now completely at a loss to understand why there is not an extensive literature of the second year teaching experience, parallel to the first year that so naturally interests teacher educators and experienced teachers. I must assume that my own experiences are similar to those of second year teachers, as the tasks become so much clearer and straightforward, so that there is more time to deal with each student's unique strengths and weaknesses.

"What's in your head and what's on the turf"

One of the pre-service physics teachers was quarterback of the Queen's football team that won the Canadian university championship in November 1992. It seemed important to be attentive to his experiences of practice teaching because he has had many years of intensive experiences being coached in his role as quarterback. From him I learned some interesting things about football, including the extent to which his movement in every play is tightly scripted. He spoke about "feeling the turf" and from this we moved on to talking about the difference between "what's in your head" and "what's on the turf." It seems an important contrast because some beginning teachers appear to know exactly what they want to do but then have trouble doing it, while others seem to teach quite successfully but have great difficulty understanding why or putting their experience into words.

I felt this same tension in both of my courses, as I taught, and also as I moved between the two settings. At Queen's, how I think about what I am doing seems particularly important, but every day there came a time when I closed the office door, drove to the school, and put my feet back on the turf that I am paid to think about. I think I stayed in touch with the Grade 12 physics students most of the time. With the pre-service teachers, I think I "lost contact" at several critical stages; their reluctance to speak and my reluctance to push them to speak, or my inappropriate efforts, combined in ways that meant that what I wanted to be doing got ahead of what they perceived me to be doing. It is not at all automatic that my daily teaching experiences would translate into meaningful class content for those on the very early edges of a teaching career.

Bridging the two worlds: Theory and practice

We can talk about the worlds of theory and practice, but I am not convinced that these contrasts mean much to either of the groups of students that I taught this year. The data about what the Grade 12 students said they wanted to learn about electricity give some sense of how the world of theory (in physics) differs from the world of practice (everyday experience) for them. Several recent experiences with student teachers who had more difficulties than most in their teaching practice have made me question the extent to which on-campus instruction has any direct impact on initial teaching behaviors. I ask this recognizing fully that most new teachers would give considerable credit to the preparation they received before practice teaching. And student teachers give a great deal of credit to the real world of practice teaching, but not to the process of making sense of how they learned from experience.

My experiences this year, working with student teachers in physics while also teaching in the school, led me to wonder about the way learning from experience is viewed by student teachers and those who receive them into their classrooms. On-campus courses are often criticized for inadequate preparation, but the learning process during practice teaching seems to be taken for granted, much as learning from laboratory experiences is taken for granted in a course like physics. *No one seems to see learning from experience as a deliberative process*, grounded in evidence from the students--a thoughtful activity just as learning a subject requires effort of the mind. Just as teaching in the school *and* university is centred on *telling* (and other forms for the transfer of information), so learning to teach centres on *telling*; the experienced tell the less experienced what works and what does not. Personal learning from experience is not considered, any more than student learning experiences in the classroom are considered. *All that matters is the right answer, or the right performance*--not how you got there or why you thought what you were doing was "right" or "appropriate."

My personal conclusion is that learning *how* to connect the two parallel tracks of experience and thinking about "teaching and learning" is central to personal development as a teacher *but* is ignored by both schools and universities. Experienced teachers and teacher educators *tell* beginners how to think about what they are trying to do. *Rarely* do they *listen* to the beginner. *Rarely* do they encourage beginners to listen to themselves or to their students (who of course have little experience being listened to). The school/university environment is a *telling* environment, not a *listening* environment. Just as we do not examine our own teaching practices, only those of others, so we do not prepare new teachers to examine their practices and learn from them. The cycle repeats itself as beginning teachers gain experience (at any level of education) in settings that do not value (or passively discourage) thoughtful analysis of practice. Teachers can think. Teachers must practice. Bringing thought to bear on practice seems to be the missing link, but there seems to be no way to cut into the momentum of our traditions of NOT thinking about how we learn from experience. Action research touches very few.

One central characteristic of this attitude toward learning from experience is expressed by Richert's (1992) concerns about voice. Another central characteristic comes from the perspective of authority. My research colleague, Hugh Munby, and I have taken data from the students in my physics methods course and argued that those learning to teach are never shown how experience itself can have authority. So much of teacher education proceeds from the authority of position of those who have knowledge of education (professors) and teaching experience (teachers and some professors) that the "authority of experience" itself is never recognized (Munby & Russell, 1993).

Using a computer to "listen to experience"

I hesitate to leave this topic without mentioning the experience of writing daily computer files about each day's teaching of the Grade 12 physics course. When I began the process, it seemed important for research purposes: How else could I look back with any kind of detail at the daily progression of my experience? As I look back now, I realize that it was crucial to my own sense of "voice" and also to my efforts to learn about what we are now calling "the authority of experience." Writing the notes was much more than establishing a detailed record. Each day's notes were crucial to my awareness of what I was doing and to my awareness of at least the top layers of the students' responses to my teaching. When I felt "down" after a lesson, the process of seeing an account move through my fingers to a screen where the visual record prompted new thoughts *always* resulted in new insights into what had happened and new ideas for a better lesson the next day.

The experience of documenting the trail of my daily teaching gave depth and meaning to statements of Lytle and Cochran-Smith (1992) about teacher research as a way of knowing:

> Teacher research is a powerful way for teachers to understand how they and their students construct and reconstruct the curriculum. By conducting inquiry on their own practices, teachers identify discrepancies between their theories of practice and their practices, . . . Inquiry stimulates, intensifies, and illuminates changes in practice. (p. 458)

This computer-based process is certainly one way for any teacher to begin to develop voice and an understanding of the authority that resides in the experiences of self and students in the classroom. I am at a loss to explain why I have never maintained such a record in the course with the preservice teachers, although having class twice a week rather than every day means that there is no need for a daily routine. I will definitely construct such a record in that course next year.

Transmission or interpretation? Technique or epistemology?

My experiences in two contexts have taken me back to the distinction Barnes (1976, pp. 144-145) draws between transmission and interpretation. For the first time, I began to read his contrasts from the perspective of teaching people to teach as well as from the perspective of teaching physics.

> The transmission teacher (1) believes knowledge to exist in the form of public disciplines which include content and criteria of performance. The interpretation teacher (1) believes knowledge to exist in the knower's ability to organize thought and action.
>
> The transmission teacher (3) perceives the teacher's task to be the evaluation and correction of the learner's performance, according to criteria of which he is the guardian. The interpretation teacher (3) perceives the teacher's task to be the setting up of a dialogue in which the learner can reshape his knowledge through interaction with others.

I have cited only two of Barnes' four elements in the transmission- interpretation contrast, but these serve to paint very broadly two quite different approaches to either the teaching

of physics or the teaching of physics teachers. My head tells my feet that the classroom experience should approach the views of the interpretation teacher. In the school classroom, I often feel like and am perceived to be a transmission teacher; this goes with the agreement to maintain a pre-determined pace through the course content. The Grade 12 students' final comments indicate that some students would have liked me to be a better transmission teacher than I was, while others reported interpretation features that I was pleased they noticed. In the university classroom, it takes a very long time to shift students from their initial expectation that I will transmit to them "the collective wisdom of thousands of physics teachers."

This year I feel I have been less successful than in preceding years at helping those learning to teach to realize the value of an interpretation approach. There is no simple explanation for this conclusion, and I see no value in finding fault with either the students or myself. They do seem willing to "tell it like it is" when I ask for their comments, and I have studied their written and interview statements closely and carefully. I will continue to interpret the year's experience as I read their stories of their time in a preservice teacher education program. I have already developed a long list of revisions for next year's course. More detail about the perspectives of the group learning to teach physics is presented in the paper mentioned above with reference to the "authority of experience " (Munby & Russell, 1993).

Hugh Munby and I recently reviewed a book that describes seven teacher education programs based in some sense on the concept of "reflection" (Valli, 1992). Our broad conclusion (Munby & Russell, in press) is that it is far easier to include in teacher education programs a variety of techniques that foster reflection by those learning to teach than it is to construct a new epistemology of learning from experience (or to develop the unique ways in which experience can have "authority"). By teaching simultaneously in the two contexts of school and university I gained a range of new perceptions that provide me with several new beginnings for continuing the quest for teacher education practices that express an interpretation perspective and that make the term "reflection" meaningful at a level of epistemology as well as technique.

By participating in both school and teacher education contexts for an extended period of time, I came to understand the position of Lytle and Cochran-Smith (1992) in a way that gives new twists to their predictions for the implications of what they see as teacher research.

> The notion of knowledge for teaching that we propose is "inside/outside" rather than "outside-in", a juxtapositon that calls attention to teachers as knowers and to the complex and distinctly non-linear relationships of knowledge and teaching, as they are embedded in the contexts and power that structure the daily work of teachers and learners in both schools and universities. As teacher research of various kinds accumulates and is more widely disseminated, we believe it will present a radical challenge to current assumptions about the relationships of theory and practice, school and universities, and inquiry and reform. (p. 469)

Working in two contexts permitted me to appreciate the meaning of "inside/outside" just as Richert (1992) encouraged me to find my own voice in the daily challenges of teaching *and* teacher education. It was an exhausting pace with rich and relevant rewards. I am sure that my decision to return to the classroom was related to my personal sense that "current

assumptions about the relationships of theory and practice, school and universities" have long required "radical challenge."

> Legitimating the knowledge that comes from practitioners' research on their own practice is a critical dimension of change in both school and university cultures. In challenging the university's hegemony in the generation of expert knowledge for the field, teacher research also challenges the dominant views of staff development and pre-service training as transmission and implementation of knowledge from outside to inside schools. Thus it has the potential to reconstruct conceptions of the ways teachers learn across the professional lifespan, so that inquiry is regarded as an integral part of the activity of teaching and a critical basis for decisions about practice. (pp. 469-470)

My position as a teacher/researcher in the university context made it much easier to see my in-school role as that of teacher *and* researcher. Indeed, I realize now that I have resolved the dilemma of collaboration (Feldman, in press) in an interesting way, by taking on the teaching role in a school and thereby enabling my "self as researcher" to collaborate with my "self as teacher."

As university-based researchers in education have worked to study teaching from the "outside-in" perspective, they seem to have overlooked the golden opportunity to do research on their own teaching within teacher education programs (Munby & Russell, 1993; Pinnegar, 1993; Placier, 1993; Hamilton, 1993; Guilfoyle, 1993). Challenge to the university's hegemony is long overdue, and if teacher research is a way of knowing, then it must be a way of knowing in universities as well as in schools. More than anywhere else in the university, programs of teacher education must not only admit but also adopt research on their own teaching as a way of knowing. Only then will appropriate views of staff development and pre-service training emerge, as teacher educators listen to their own students and also to themselves.

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DETAILS OF DATA UNDER FIVE MAIN HEADINGS

WHAT WAS DIFFERENT IN MY SECOND YEAR OF TEACHING IN TWO CONTEXTS?

Class 1: A big class. It was SO MUCH EASIER than last year, when I'm sure I was completely lost. I did two demonstrations right away. My goal was to set an attitude, and there were occasional below the surface noises that I was succeeding; I thought I heard hints that "this could be good." Of course why physics is hard is beyond them at the moment. I told them there would be visitors, and videocameras. I told them about working with beginning teachers and with them--to try to help both groups. I told them there would be tutors available. I'm sure I set a "different tone."

Class 4: Quite unlike last year, I pointed to each of the three sections of homework problems and spoke about what was involved and what equations would be used--first velocity, then the simple version of Snell's Law, and then the more general. I NEVER did that last year, and I'd really like to know if it made a difference. That's picking up directly on K___'s suggestion, and it felt very good to do it--certainly shows the difference between seeing a problem the first time and seeing it "forever after." So much of this is perceptual.

Class 5: Initial notes on the school culture:
Life with _____ is SO relaxed compared to last year! He's prepared a draft for the Independent Study--"Make any changes you like". Then he asked about something at the end of my class, and I thought he was referring to my physics class, but he was thinking of what he heard in a brief stop at the end of the method class. I thought something about my teaching was up for grabs--memories die hard--but this suggests _____ is really attentive to the method students and I need to watch for and encourage that!
In the staff room I sat down (for the first time??) at the table and checked the day's attendance sheet against my absences. S_____ was there and we chatted a bit, and she said how impressed people were that I was there again this year. I guess that means not just a one-semester stand. Many of the staff still look like complete strangers, so it was very nice to get that kind of comment.

Class 6: *Wow*--this morning I told Jack I was on a "practice high"--I still am. I told _____ I would have been crazy to not come back this year--I would never have known how much BETTER this year is--never have realized how much I LEARNED FROM EXPERIENCE. So much more a part of things, so much easier to respond to each event. *Amazing. Exciting.*

Class 7: This morning, in our research meeting, I mentioned that there seems nothing in the literature about the "second year teacher" (which I am simulating to some extent). Something to follow up there--that's probably a major theme for writing up this fall's experience.

Class 10: Lab coming up today, and that raises yet another set of issues to be raised about what I expect of them. This opening of the school year reminds me how little students often seem to be able to do beyond the recipes provided by teacher and text. It's so hard for them to look for the central idea. What is it that we do in school that makes kids this way? Is it always an arbitrary experience for them????

Class 20: During class _____ brought in draft copies of two versions of next Tuesday's quiz. I worked them at home tonight and then phoned him with a few suggestions. I had misinterpreted his intentions in one problem, and that suggests rewording. He had set up a problem that gave the velocity of sound as twice what he intended, so it was a good example of two heads better than one. I told him I DO appreciate his efforts in producing these quizzes and tests. He asked if I was organized for independent study presentations and I thanked him for the reminder. It's incredible how much there is to think of at this stage--it's all so much more diffuse than in the first few weeks.

Class 42: At first I wondered what did happen yesterday. We began with some questions about homework, and I quickly noticed the effect of not having taught recent classes [because a student teacher taught for most of three weeks]. The material was NOT at my finger tips, the detailed knowledge that can ONLY come from teaching material recently. It's no good watching someone else teach it; it's just not the same thing. (That must be related to the fact that the teacher learns the material so much better than the students the material is taught to!)

It felt good to be back at work with "my" class. At some point this week or next I should try to explore their experiences of a student teacher. The change was good--it gave me more detail on some students' work, and it gave me additional ideas about what the effects of daily teaching are.

Class 43: 60 minute class before the semi-final football game. This class FELT good. The focus was preparation for the test tomorrow. Since this was only the second day after [the student teacher] finished, I'm still catching up on what had been taught. Here I could FEEL last year's teaching coming back to me as I focussed on the idea of gravitational field strength (and I acknowledged that the concept of "field" has not really been addressed yet). This involves showing how putting F=ma with F= GMm/R squared gives g=GM/R squared. Some of them did seem to follow, and K_____ asked about it afterwards.

I worked several homework problems similar to ones they will do tomorrow. Then I asked them if they wanted to work at their seats or continue at the board, and they chose to work at their seats. I feel good when they make that choice, despite the obvious "comfort" of being at the front of the room. I am sure I answered a dozen individual questions, and some good questions were asked. They WERE trying to put the material together.

WHY IS THE PACE OF THE PHYSICS TEACHING SO FRANTIC IN THE GRADE 12 COURSE?

Class 4: I had the overwhelming sense that this lesson has TOO MUCH in it. There are two concepts, both linked in the idea of "index of refraction"--which gives both the change in velocity of light from one medium to another, and the actual bending of the light calculated through Snell's Law.

Class 8: We rushed on to addition and subtraction of colours. I enjoyed the demonstrations, starting with the carbon arc and prism to produce a rainbow (dispersion). The addition and subtraction demonstrations work reasonably well. But no time for their questions. What do they make of seeing somebody stand at the front and perform "out of the blue"?

Class 15: During the test, _____ told me how much he was taken aback by the low performances of some of the students in the first papers he marked. That braced me for what I would see and hear as the students left, and reminded me that I too had forgotten how difficult students find tests in physics. _____ does write "hard tests" but this first test is also our first time to show them what to expect. But of course we could have given them something similar last week as preparation, and we didn't..... (we were busy covering the course outline). (The aside just shows how often I wonder whether there is a choice between coverage and understanding, or if we had more time would we just take more time but not really achieve more understanding.)
MARKING THE TEST: The math errors were at times overwhelming. This would NOT make me want to be a math teacher.

Class 18: LATER--after hearing Gary Fenstermacher [visiting Queen's during his leave from Arizona] on the educative relationship:
What was I doing up there? Going through the paces of "delivering the pizza"--and not really sure why and where it was going. That's OK occasionally, but they let me do it all the time. I wonder if I can make tomorrow's lab more interesting by asking them to consider the two-point-source interference pattern for the first time in the ripple tank, after seeing the standing wave that we have discussed at some length??

Class 23: A real eye-opener. They ALL have trouble moving from word problems to setting up the math, and then MOST have trouble moving through the mathematics. Most manage to do one step in their heads and in doing so they usually find the reciprocal of what they need.
Just time at the end to have four of them walk across the front to hear the interference pattern, and then to show them beats with the two speakers and then the two tuning forks, and a rush through the subtraction to get the frequency of the beats. On to the homework... Can't believe the pace before the test on Monday....

Class 23: SUPPLEMENTARY NOTES: They all seemed to know what to do with the reflected echo of a pure note--they had just seen and heard it. BUT they did NOT know how to tackle the first problem using the wave equation--which I thought was the one thing we could take for granted. (And now I'm faced with a test after three more classes, and virtually everything on it is to be covered in the next three days. And what I really want to do is say to the class: "For goodness sake let's slow down and figure out what's going on here! Some of you 'pick it up quickly' but others of you are 'going along for the ride'--not putting a critical edge on what happens to you each day."
I could NEVER teach math after what I saw them do with $v = 332 + 0.6T$ -- they made every mistake possible. But I AM teaching math because this course is organized as a course that tests concepts by setting math problems.
So they have never been TAUGHT to make ritual knowledge into principled knowledge (Edwards & Mercer, 1987), and that doesn't seem to happen by accident for most people. AND such teaching is rare or nonexistent in schools, so any moves I make seem foreign and uncomfortable. In my own mind, with this group, I think I could make some progress--but how do I get them "on board"?

All this suggests that it is utterly unfair and inappropriate to single out pieces of ANY teacher's behaviour for comment and repair. What matters to me is that I am noticing and attending to all these issues associated with my students, and that I am trying to work with what they can tolerate and what I can cope with by way of modifications--within the very tight constraints of covering the curriculum on a treadmill and enduring the quizzes and tests that tell you for the first time what you should have learned. So little room to maneuver when the basic frame is so similar to what they have come to expect of school-- the teacher has a virtual reality and you are expected to figure it out.

Class 53: hmm--STILL no review problems given out, STILL no independent study presentations. NEVER any extra time. Still learning, still enjoying, still pleased with the class. Still convinced that great lessons are inspired by "backtalk" from the previous lesson or two.

Class 69: The real point of this note is to capture some of my "if I could do it over again" thoughts about the electromagnetism unit. I spent a whole day on motors and generators, trying to relive a wonderful day a year ago, only to realize that none of that material would be on the test. The more basic ideas seem to elude the students--the full meaning of "a changing magnetic field creates (should I have said induces?) an electric field", the sense of difference between AC and DC in the sense that the magnetic field around DC is unchanging.

This has been as "low" a unit as electricity was high. No help that we lost last Friday [to a blizzard]. No help that I was running flat out the whole time, with no chance to stand back and re-group. We are back to very abstract points, with much to be taken on faith. Demonstrations probably need to be done OVER AND OVER AGAIN, with writing and questions and even giving them time to talk. Along the way, learning to do calculations based on turns, current, and permeability are mechanical and tedious distractions to the real issues at hand. Maybe I can assemble a collection of the responses to explain e/m induction. I expect some winners!

WHAT DID THE GRADE 12 STUDENTS THINK OF MY TEACHING?

First request for comments, after 12 classes:

Class 12: I enjoyed this class. It was the day of the first football game, and we actually ended 15 minutes early so they could watch the game if they wished (I don't think many did). I started the class by giving them half-pages of yellow paper to write what they like and don't like about the subject or the way I am teaching. I set it up by saying that most teachers are like each other, but from the very first day they automatically make comparisons. I was glad to have 2 B.Ed. observers there to see it happen!! They did write--apparently quite readily.

As I think about the comments and how I reacted to them, once I got home, my first sense was positive and the after-effect was more negative. Overall, I have to be glad to get this with 6/7 of the course still to go. There is quite a mixture of ideas, and some inevitable contradiction between the comments. More to the point, I now have NEW THINGS TO THINK ABOUT, things that I was beginning to take for granted. There are no easy answers to this stuff--there is only so much time and choices have to be made about how to use time-- and there is no place for "perfection" in the context of day-to-day teaching (it's NOT like a workshop full of glitzy demonstrations). What seems important is that I keep thinking, and that I keep trying to check with them about how my actions affect them.....

Backtalk from Grade 12 Physics after first 12 classes
(in case you didn't think impressions form quickly!)

* Everything everyone said about physics is true. It is a really hard and demanding course that I probably won't pass. There is too much homework and we shouldn't have any on the weekends because we spend all week doing it already. As for Mr. Russell, he's a pretty cool guy, he just needs to work on organizing his notes on the board before we all go insane!

* Along with the typed notes you give out (which are a good idea), you might want to consider if teaching a new formula or something, writing an example or two (maybe one easy, one as hard as they get) on the board and going through them step by step with the class slowly.

* I would (along with many others) appreciate it if at the beginning of each class we went over the homework thoroughly! Preferably WRITTEN ON THE BOARD so we can compare - find out how, why and what we did wrong. We don't always have to follow the "schedule" exactly as directed. I feel if we didn't rush as much we would understand more clearly, and would probably take the time to enjoy it.

* Would prefer to go over homework more often with teacher rather than in groups. I find we're rushed through lessons because we have to stay on schedule. And this leaves no time to go over homework. I would prefer to take notes off the board instead of handouts.

* I like the visuals that go along with the lesson, and working in groups to check homework. I don't like writing down my likes and dislikes. I would like better notes to go along with the discussion.

* I am impressed with your method of teaching. I find you are an excellent teacher so far and I'm glad I am taking it again with you teaching. I find you very fair, and I'm glad you give the notes as handouts as I find it boring to re-write my notes again.

* One thing I don't like or I wish it could be done differently is that not everything is explained thoroughly. For example, labs could be gone over step by step before doing them so then I don't have to ask lots of questions during the lab. I don't pick up on things that aren't explained. When given notes on things, I find it easier to copy off the board because then I learn as I write, but when I'm handed a sheet with typed notes I don't read it. I do enjoy the course, it's interesting. I'd just prefer if things were explained better.

* I hate the course outline. It would be nice to think that maybe there won't be any work sometimes, and that outline kills any possibility of that happening!! Other than that (and the fact that the course moves too fast) everything is all right.

* Physics is kind of what I expected it to be. I like the way you go through examples on the board during class and then hand out a typed sheet on the lesson to clear up points. When we start new topics I sometimes get lost, but soon pick up what we are learning.

* This class has been pretty hard so far but you're doing a pretty good job of making me understand. I like that we don't have to write our own notes because that always seemed like a waste of time to me, but on those notes you might want to explain the formula(s) a bit better so we know what everything means.

SECOND REQUEST FOR COMMENTS, after 23 classes:

Class 24: BACKTALK #2 at the beginning of the period--BEFORE we did any problems or returned the quiz. Just talked to Doug, who says they are quite outspoken and critical of not being taught to do certain types of problems--but the essential thing to me is that they trust me enough to say those things--Doug will drop them off first thing tomorrow--but I also have a review sheet to produce--and I'd better be ready with the homework (which doesn't amount to much--I really need to study the test so I can give them what they need for those problems. I wonder how the notes and problems on the board today spoke to what they said.

This definitely felt like a different class--I was seeing things differently, even if they weren't. It's hard to describe--it FELT different, but looking back it is hard to say WHAT was different. I was running on feelings more than thoughts might be one way of putting it; maybe I was just trusting the new image, which had been given some verification by talking with _____ last night about how he approaches problems.

BACKTALK after 23 classes, near end of second unit:

Class 24: This was collected at the beginning of the period following the quiz on which half the class had a score below 50, so their mood may have been low!

* An improvement is that we've been going over the homework more frequently than before - make sure to continue to do so. Problems period should be devoted to problems only and not a lesson.

* Physics is getting a lot harder - and a little boring. Wave unit went by fast and it is just assumed that we understand things. Basic ideas are not explained clearly as to where these ideas are used.

* There is too little time to discuss the homework which we will be attempting that night. I find myself unable to do the homework properly because I don't really know what I'm doing. We need FULL solutions to problems and not just the answer.

* I am finding Physics to be a lot harder than I expected. My mark isn't as high as I'd like it to be. I'm not catching on very fast to the work. It's not the math that bothers me, it's where to apply it. I think you are teaching too fast and I'm not used to being in a class where things are totally independent. I think it would be better if you stated when our tests are because I don't remember to look on that handout.

* I think we should slow down a little. The rest is the same. I like your teaching method, I like the handouts of clear material.

* I find the problems are hard to get into the equations and formulas. The math isn't THAT hard when I have the numbers in the right places. It would help if there were more examples of the questions done in class step by step. It would also help if we could understand WHY the things are how they are.

* The biggest problem I have is translating the words into a mathematical equation. I also think we should take 10-15 minutes at the start of class to do one or two questions on the board.

* I have problems applying the various theories and formulas to specific questions. I understand all the theories, ideas, etc. but cannot seem to apply to various questions, especially questions I have not encountered before.

FINAL REQUEST FOR COMMENTS, at the end of the semester:

* Mr. Russell, you are probably the best teacher that I've had in high school. Often I think you understand things too well to explain them clearly. I didn't really want to take this course but you made it relatively interesting. P.S. It is impossible to copy your notes off the board (in an organized manner).

* I really do like the way you've taught this class! You didn't baby us the way some teachers do, but you seemed to care about us (or that's the impression I got) and not just so you look good with a good average, but so we understood and did well. Even though it was harder for you, you always made yourself available for extra help. I've never really done incredibly well in science courses, but this course ended up being a lot more straightforward and interesting than I thought it would be.

* I will remember that you tried to make it interesting - that it wasn't just a bunch of laws, theories and equations but something that was actually relevant. I will also remember that you didn't try to make the course completely serious - that it was a comfortable atmosphere.

* I think that more examples of questions involving the equations should have been done. This would have helped a LOT!!

* I thought the course was taught well. The instructor made the topics interesting by doing experiments and light comedy routines. Too much time was watching videos that didn't keep the students' attention and thus wasted a fair amount of time.

* You taught well, even though the subject matter was somewhat difficult. I think you did a pretty good job, considering the topics. I will remember how you don't make notes (on the board) like other teachers do, but your written summaries were quite helpful. I also will remember the written feedback you had us do, because no other teacher has/does that.

* I really liked the way you taught this class. I think you explained things in a way that made us think instead of just reciting things. The only problem was if I missed a day - it was lost, but I suppose that is because of the course. I was prepared to fail physics, and I think I did better than I ever would have expected, and this is probably because you taught really well!

* It has been very nice having a teacher with some different views teach this class. Looking back I realize that there are many teachers who could have made this course the worst experience of my life! The only thing I thought you did wrong was being too relaxed with the independent studies. I know that in many cases (almost everyone) the independent study was never even started until you put pressure on us. We are used to having a deadline to work for or no work will get done. Other than that I enjoyed your teaching and I know my mark would not be this high without your help.

* I liked the way you taught the course although sometimes you probably could have explained what we had to do in the homework a little. But overall, your methods are very good and you made me understand well.

* The thing I will remember about the way you taught the class is how well you got to know everyone. I thought it was very outgoing to have taken pictures of us to get to know everyone. Also I felt that you were always aware how well everyone was following each topic.

WHAT KINDS OF QUESTIONS DID THE GRADE 12 STUDENTS REALLY WANT ANSWERS TO?

The Grade 12 physics course in Ontario has six required units: Geometric Optics, Mechanics, Electricity, Electromagnetism, Sound, and Nuclear Physics. We began with the unit on light and then studied sound, including waves. The mechanics unit, the longest, came next. By the time we began the electricity unit, I told myself "I really want to try to make this unit practical and meaningful in an everyday sense." They asked these questions at the start of the electricity unit (class 48) and the list gives some indication of the difference between student and teacher perspectives on a major unit in physics.

- How is electricity made and stored?
- How did they measure the maximum current a person can take? Live experiments or mathematically?
- Can electricity be converted into a light pulse and transferred by satellite?
- What is the most efficient method of transferring electricity from one point to another?
- What causes electricity to kill you?
- How much of it does it take to kill you?
- How is electricity stored in batteries? How do they get a certain voltage out of batteries (e.g., 1.5 volt, 9 volt)?
- Where did the term "volts" come from?
- What would happen if you put your tongue in an electrical socket?
- Why isn't electricity free?
- How much damage does a lightning bolt do?
- How come you can't see or hear electricity?
- What is the equation for solving parallel circuits?
- Why did they call Volts Volts and not Johns or Freds?
- At what voltage does an electric charge become lethal?
- What is electric shock therapy?
- What's inside a light bulb?
- How is light created by electricity?
- What's inside of a light bulb?
- How does one work?
- How is electricity generated?
- How come we get shocked when we touch something metallic?
- How do light bulbs run out?
- How does a light bulb work?
- How come shocks can be very tiny or very painful?
- What causes lightning?
- Where did Andre and Marie Ampere live when Oersted made his famous discovery that a wire carrying an electric current could deflect a magnetic needle?
- Why do you conduct more electricity in water?

How did the visits of the B.Ed. students to the school and my visits to observe them as student teachers during practice teaching affect my work with the two groups of students?

Class 11: This is all exhausting but exhilarating. I told the B.Ed. students that I need to have short conversations with them just to keep in touch with what's happening to them--yes, it is important to get to know them, but even more, I need the backtalk to keep me thinking and planning. Interesting realization!

Class 18: What I have been waiting for finally started to happen-- the [physics methods] students started asking me real questions about what they saw [in the Grade 12 class] and about what I did and didn't do. And it felt so good-- it wasn't them being told what they did right or wrong, it was someone telling them what teaching looked like from the inside, which is NOT what I see as the role they get to play during student teaching. But somehow they got the message.... and the courage to ask!!!

Class 57: There were important parallels in my mind between my experience visiting T_____ and my frustrations with my own lesson yesterday. Background: The experienced science teacher

knows the subject so well that the student's very clear sense of the difference between what's real--equipment, demonstrations, labs--and what's theory--laws, ideal problems, formulas, mathematics--is blurred and may not even be perceived. I'm teaching in a situation where the students have been taught for years, inadvertently, to ignore that difference and go with the theory. This was evident when the students had so much difficulty making the wires look like the diagrams on paper. [A_____ and L_____ came in yesterday to repeat the circuits lab; Doug was able to tell me that on Monday they were completely lost--A_____ is the "best" student in the class, in terms of his mark at the moment, but in the world of reality, he's lost.] The student teacher also knows the subject well enough, in most cases, that the theory-real world contrast is taken for granted. [As I watched T_____ do his demonstrations, I thought how hard it is to ensure that students are seeing what we are seeing--the apparatus looks so simple, yet understanding it requires the ability to focus on some parts and ignore others.]

It seems to me that there is an EXACT PARALLEL for the education professor who goes to a school to watch a lesson by a student teacher. WE have become so accustomed to the territory that we have lost a clear sense of the difference between "what's in the head" and "what's on the turf"--and we have forgotten what it was like to move back and forth between the two. BUT that's what my daily teaching HAS THE POTENTIAL to do for me--it doesn't do it automatically, but when I get talking with Doug or e-mailing to Jack, Anita, Stefinee, John, Henry, I write about my experiences in ways that can illuminate that contrast between thinking and doing. And I am REMINDED that there is so much in my head that I would LIKE to do with my students (such as have them understand rather than memorize, thinking about what they are learning, CARE about EXPLAINING the phenomena that physics speaks to) that just never seems to happen as we rush through problems and formulas and board notes on our way to the quiz (today) and unit test (on Friday). The evaluation process feeds the blurring of the contrast between ideas and experience, and the issue of "making sense of experience" through thinking and writing is completely lost. [A graduate student who finished her fourth year of teaching last June just stopped in; she's very good at seeing these contrasts and tensions in her recollections of her B.Ed. program and the expectations she faced in her first four years of teaching. Very timely.]

I still haven't mentioned the tension I felt with T_____. He has a wonderfully patient and calm style that I felt I would like to copy. After watching his 60-minute lesson, there was much I wanted to talk about, but it was incredibly difficult to start out just saying "You did x, y, z very well." Why was it difficult? Because I had to get him to talk first to tell me what the territory feels like. That's what Doug did with S_____--he had all afternoon to do it. With T_____, I had 30 minutes at most, with others in the room, to try to find some common ground. He did start to talk, and then I was able to start to make connections. That's what I would LIKE my physics students to do, but there are so many of them that I can't listen to all at once, AND they just don't seem to CARE (in many instances) about MAKING SENSE OF EXPERIENCE. They are trained very well to put everything away before they leave the room, and they are trained very well to "shut down" when the bell rings, but they are NOT well trained to ask questions about how the territory of physics events connects to the ideas we ask them to memorize and the problems we ask them to solve for homework and the harder problems we ask them to solve on tests.

None of this is new, but the connections between learning science and learning to teach science have been very stimulating, and they are very appropriate as I approach the end of my time in the physics classroom (84 classes in all, so only 27 to go) and as I approach the beginning of the nine week period with the physics method students (two weeks before Christmas, seven weeks after) when we focus on "working with their heads" AFTER they have had some initial experiences working in the territory, on the ground, in practice teaching.